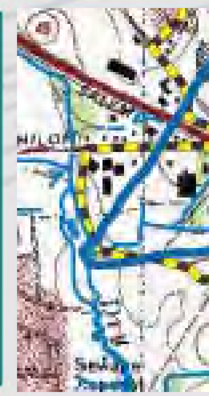

CHRISTOPHER B. BURKE ENGINEERING, LTD. - INDIANA

Honey Creek - Vigo Conservancy District
Vigo County, Indiana
Preliminary Evaluation of
District Plan

January 2009

Prepared For:
Honey Creek Conservancy District

HONEY CREEK – VIGO CONSERVANCY DISTRICT

VIGO COUNTY, INDIANA

PRELIMINARY EVALUATION OF DISTRICT PLAN

Prepared for:

Honey Creek Conservancy District
4301 South 6th Street
Terre Haute, IN 47802

January 2009

Prepared by:

Christopher B. Burke Engineering, Ltd.
115 West Washington Street, Suite 1368 South
Indianapolis, Indiana 46204

CBBEL Project No. 08-0454

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Executive Summary

The Honey Creek Conservancy District was established in 1990 for the purpose of developing plans to address the recurring flooding and drainage problems within the District. The District Plan called for the construction of 12 miles of flood prevention levees and numerous interior drainage improvements to reduce overbank and localized flooding within the District. Approximately 6.6 miles of flood prevention levees have been constructed to date with the remainder of planned levees being either under construction or not yet started. These levees were designed to provide protection up to the 1% annual-chance-flood (commonly referred to as the 100-year flood).

On June 7, 2008, heavy rainfall across southern Indiana led to widespread flooding resulting in three deaths, thousands of forced evacuations and nearly a billion dollars worth of property damage. The area within the Honey Creek Conservancy District was especially hard hit during this event. Portions of the upper Honey Creek watershed received as much as 9.8 inches of rain over an 18-hour period. It is estimated that this rainfall along with the previously saturated ground conditions combined to produce peak streamflows in Honey Creek that likely exceeded the 0.1% annual-chance-flood (commonly referred to as the 1,000-year flood). As a result, floodwaters in Honey Creek and its southern tributaries rose to elevations higher than the district levees in a number of locations which caused levee overtoppings that flooded a significant portion of the district. Based on this, it was determined that the flooding of June 7, 2008 appeared to be the result of an extreme rainfall event that far exceeded the design storm for which the District levees and interior drainage systems were ever designed.

Several recommendations were provided for moving forward with District's role in providing flood control and prevention measures in the lower Honey Creek watershed. The recommendations consisted of several studies and action items that the district should undertake to implement additional structural and non-structural measures that will serve to reduce the risk and severity of flooding within the District. The following table summarizes the recommendations provided in this report.

#	Recommendation	Type
1	Determine best measures to minimize risk of future flooding	Both
2	Study feasibility of alternatives for mitigating levee overtoppings	Structural
3	Develop estimated flood profiles for Jordan Creek and Corn Creek	Non-Structural
4	Prepare system wide Operations and Maintenance (O&M) manual	Non-Structural
5	Evaluate whether current level of protection is appropriate for levees	Non-Structural
6	Improve levees to meet current FEMA requirements for NFIP	Structural
7	Complete hydrologic and hydraulic analysis to evaluate impacts of SR641	Non-Structural
8	Study feasibility of providing outlet for Willa Villa pond	Structural
9	Remove logjams and implement program for continued maintenance	Structural
10	Proceed with implementation of structures recommended in District Plan	Structural

1.0 Introduction

1.1 Project Location

The Honey Creek-Vigo Conservancy District is located in Vigo County on the southwest side of the City of Terre Haute in Sections 3, 4, 5, 7, 8, 9, 10, 11, 14, 15, 16, and 17, Township 11 North, Range 9 West, Vigo County, Indiana. The District is bounded roughly by I-70 to the north, State Route 63 to the west, Honey Creek to the south, and the Conrail Railroad to the east. Refer to **Exhibit 1** for the approximate location of the District boundaries.

1.2 Purpose of District

The Honey Creek-Vigo Conservancy District was established on March 7, 1990. The District encompasses approximately 4,230 acres of the lower Honey Creek watershed. The District was created to establish an organization that had the authority, power, and ability to allow the landowners to address problems within the district. The District was established to perform the following tasks within the designated District boundaries:

1. Flood prevention and control,
2. Improving drainage,
3. Developing forest, wildlife areas, parks where feasible, and
4. Preventing the loss of topsoil from injurious water erosion.

In order to meet those general tasks, the District was given the responsibility of developing plans to address the flooding and drainage problems in the District in cooperation with the sponsors and other agencies. In addition, the District was tasked with providing the required land easements and right-of-ways required for proposed improvements as well as administrating and letting contracts for proposed improvements. According to the District Plan, the District has the power to levy special benefit taxes and exceptional benefit assessments and they are able to borrow money, issue bonds, or use any other permitted methods available to provide the funds required to implement improvements and to maintain the improvements.

1.3 Watershed and District Description

The Honey Creek watershed encompasses approximately 59,500 acres at the western edge of the District before it eventually discharges to the Wabash River approximately 6 miles downstream. Major tributaries that discharge to Honey Creek within the District boundaries include Thompson Ditch, Little Honey Creek, Jordan Creek, and Corn Creek. The watershed of Honey Creek remains predominantly undeveloped although a larger percentage of the lower watershed, in the vicinity of Terre Haute, is developed with a mix of residential and commercial land use.

While the District occupies less than 8% of the overall watershed of Honey Creek, it is the most heavily developed portion of the watershed. A significant portion of the District is currently located within the Special Flood Hazard Area (SFHA) of Honey Creek and its tributaries. According to the District Plan, the SFHA, or 100-year

floodplain as it is commonly referred to, includes approximately 390 residential properties (which includes approximately 1,100 housing units), 190 commercial properties, and 1,400 acres of cropland, pastureland, and woodland. Refer to **Exhibit 2** for a view of the Honey Creek Watershed and some of the major contributing tributaries. **Exhibit 3** depicts the limits of the SFHA within the District.

1.4 June 2008 Storm Event

On June 7, 2008, a high intensity rainfall event followed several weeks of moderate intensity rainfall events across southern Indiana. The rainfall events led to widespread flooding that caused three deaths and forced the evacuation of thousands of residents. It is estimated that the flooding caused nearly a billion dollars worth of damage to homes, businesses, infrastructure, and agricultural lands. The devastation prompted a Presidential Disaster Declaration for 39 Indiana counties.

The area within the Honey Creek Conservancy District was especially hard hit during the June 7th flood. The levees along Honey Creek and its tributaries experienced isolated failures which further aggravated interior drainage problems within the District. Further details regarding the June 7th flooding within the District are discussed in later sections within this report.

1.5 Report Objectives

Christopher B. Burke Engineering, Ltd. (CBBEL) was retained by the District because of the District's interest in evaluating and possibly updating the Plan that was written by CBBEL at the formation of the District. The District is interested in determining whether possible updates to the plan are warranted to reflect changes that have occurred to the watershed since the original plan was implemented. The process of revising the District's Plan will require a comprehensive evaluation of the current hydraulics and hydrology, as well as, the structural and non-structural flood prevention and control measures that have been implemented.

CBBEL recommended a phased approach for accomplishing this. Phase I was to entail the gathering of the available data and a preliminary review of the data. This report is the deliverable for this initial phase and it consists of a summary of the available information and recommendations for the next steps that the District should take.

2.0 Background

2.1 Flood Conditions Prior to the District

Prior to the establishment of the District, significant urban and commercial development had taken place within the lower watershed, which led to the potential for high cost flood damage within this area. In addition to the frequent overbank flooding from Honey Creek and Thompson Ditch, the interior drainage networks were not well defined and usually undersized. According to the Flood Plain Management Study for Honey Creek, prior to the construction of the District levees,

Thompson Ditch would overtop its banks during the 10-year storm event. Honey Creek would overtop its banks during the 2-year storm event. Honey Creek would overtop the divide between the Honey Creek and Thompson Ditch watersheds during the 5-year storm event.

According to the Flood Plain Management Study, before the District was established, some steps were taken to address the flooding within the watershed. Some of these measures were helpful in reducing the risk of damage as a result of flooding but the steps lacked the comprehensiveness that the Districts approach would later bring. One of the significant steps that was taken was the City of Terre Haute and Vigo County choosing to participate in the National Flood Insurance Program (NFIP). Participation in the NFIP requires enacting regulations that control development below the 100-year flood elevation. Structural means of reducing the severity of flooding included the reconstruction of a portion of Thompson Ditch to provide additional discharge capacity. In addition, a water impoundment structure was constructed somewhere upstream of Thompson Ditch. Along Honey Creek, residents within a portion of the Allendale Subdivision constructed a small dike around their houses to prevent low level flooding from Honey Creek. Another dike was constructed along the north side of Honey Creek east of US Highway 41.

2.2 Previous Reports and Studies

In response to the devastating flooding that the Honey Creek watershed had experienced, the United States Department of Agriculture's (USDA) Soil Conservation Service (SCS now NRCS) prepared a Flood Plain Management Study for the Honey Creek Watershed in November 1987. The purpose of the study was to develop alternatives that would reduce the flood damages within the Honey Creek Watershed. Based on the results of the study, four alternatives were analyzed. Each of the four alternatives relied on variations of dikes/levees being constructed along Honey Creek and Thompson Ditch. One alternative also included rerouting a portion of Thompson Ditch. According to the Study, for all the alternatives, 430 houses and 190 commercial buildings that were within the SFHA would be protected from the 1% annual-chance flood (commonly referred to as the 100-year flood event). The primary difference between the alternatives was the amount of cropland that would be protected. However, because the alternatives did little to address interior drainage, many areas remained prone to localized flood damages. In addition, flood events that exceeded the design flood of the levees would still have the potential to cause significant flood damage as a result of levee overtopping.

The Watershed Plan – Environmental Assessment was prepared for the Honey Creek-Vigo Conservancy District, Vigo County Soil and Water Conservation District (SWCD) SWCD, Clay County SWCD, and the USDA SCS in 1990. The purpose of this study was to summarize the environmental issues within the watershed, summarize the alternatives developed to address the flooding problems, and recommend an alternative to address the flooding problems.

The Work Plan for Flood Prevention and Drainage Improvements was prepared by Christopher B. Burke Engineering, Ltd. (CBBEL) in 1991. The purpose of this study

was to develop and analyze several alternatives that addressed the interior drainage issues within the watershed.

2.3 Honey Creek – Vigo Conservancy District Plan

In March 1990, the Honey Creek – Vigo Conservancy District was established. At that time, the Conservancy District prepared a District Plan which presented the potential impacts of the flooding in the District, the improvements needed in the watershed, the locations of the improvements, and the benefits of the improvements. The District Plan called for the construction of 12 miles of flood prevention dikes (or levees), 1,000 feet of intermittent tributary stream, and several smaller components to reduce localize flooding.

The steps that were outlined in the District Plan consisted of installing four levees along Honey Creek and four levees along Thompson Ditch. Honey Creek Levee 1 was to be located on the north side of Honey Creek from approximately 0.6 miles upstream of State Highway 63 to U.S. Highway 41. Honey Creek Levee 2 was to be located on the south side of Honey Creek from the center of the NE ¼ of the NW ¼ of Section 17 to Rigney Road and then along Rigney Road for approximately 0.7 miles. Honey Creek Levees 3 and 4 were to be located from U.S. Highway 41 extending upstream approximately 4,000 feet. Thompson Ditch Levees 1 and 2 were to be located from the junction of Honey Creek to U.S. Highway 41. Thompson Levees 3 and 4 were to be located from U.S. Highway 41 to the Conrail railroad.

In addition to the levee system for Honey Creek and Thompson Ditch, the District Plan addresses the interior drainage issues within the District. For the purposes of interior drainage analysis, the District was divided into four quadrants: northeast, northwest, southeast, and southwest. The interior drainage measures recommended for the northwest quadrant consisted of an overflow channel from the I-70 pit to the Jones' pit. For the northeast quadrant, the components consist of a 48-inch equalizer pipe between two pits and a relief sewer and open channel combination. The relief sewer begins at the intersection of 9th Street and 39th Drive and runs south before turning west to run along the back of the proposed levee. The relief sewer crosses underneath 7th Street and then outlets into an open channel, which flows along the levee before turning north and discharging to a pit.

Both the southwest and the southeast quadrants include an open channel system and detention storage areas. In the southwest quadrant, the Middle Channel was proposed, which includes a main channel with four tributaries and a detention storage area. In the southeast quadrant, the East Channel was proposed, which includes a main stem, two laterals, and a detention storage area. The southeast quadrant also included the Railroad Channel, another detention storage area, and improved roadside drainage in two locations.

2.4 Implementation of District Plan

Since the acceptance of the District Plan, several components of the plan have been implemented. Phase 1 consisted of constructing a levee along the north side of

Honey Creek from U.S. Highway 41 and extending upstream approximately 4,000 feet and along the south side of Honey Creek from U.S. Highway 41 and extending upstream approximately 2,400 feet then turning south for approximately 800 feet. Phase 2 consisted of constructing a levee along the north side of Honey Creek from approximately 0.6 miles upstream of State Road 63 to U.S. Highway 41 and along the south side of Honey Creek from 2,000 feet upstream of the junction of Thompson Ditch to Sullivan Place and then turning south along Sullivan Place approximately 4,200 feet. Phase 3 consisted of constructing a levee along the east side of Thompson Ditch from the junction with Honey Creek and extending upstream to Springhill Drive. The remaining portions of the proposed levee system have not been constructed.

The most significant component of the interior drainage system completed to date is the Middle Channel's main channel and detention storage area. Construction of the lateral channels for the Middle Channel has not yet been completed. In addition, the East Channel has not yet been constructed.

Refer to **Exhibit 4** for an overview of the major proposed and completed components from the District Plan.

3.0 June 2008 Flood

3.1 Discussion of Precipitation Data

In order to determine the likely depth of rainfall that occurred in the Honey Creek Watershed during the June 2008 flooding, CBBEL relied on Doppler radar based mapping of rainfall depths as provided by the National Weather Services (NWS). The Doppler radar mapping appears to show that the rainfall depths for the upper Honey Creek watershed were as high as approximately 9.8 inches in the southern sub-watershed of an Unnamed Tributary (UNT) to Honey Creek and up to 9.4 inches in the southern watershed of Jordan Creek. The rainfall in the northern watershed was considerably less at just under 5 inches in some locations. Rainfall within the District itself appears to have varied from approximately 6.4 inches to 8.3 inches according to the Doppler radar data. Based on available hourly and 6-hour rainfall gages in the surrounding area, this rainfall event took place over about an 18-hour period beginning either late on June 6th or very early on June 7th. **Exhibit 5** shows the Doppler radar mapping for the June 7th event.

Precipitation frequency estimates were obtained from NOAA Atlas 14 for the Honey Creek watershed in order to determine the exceedance probability (the inverse of which is commonly referred to as the return period). These estimates are contained in **Appendix 2**. Based on an estimated average rainfall depth of 7.4 inches within the District over an 18-hour duration, the average precipitation total within the District would be classified as an approximately 0.33% annual-chance-rainfall (commonly referred to as a 300-year return period). With an estimated rainfall depth of up to 9.8 inches in the southern portion of the watershed over an 18-hour duration, the maximum precipitation total for the southern portion of the watershed would be

classified as less than a 0.1% annual-chance-rainfall (or greater than a 1,000-year return period).

It is important to note that the heavy rainfall of June 7th followed several weeks of moderate intensity rainfall within the watershed. This series of moderate intensity events created saturated ground conditions and higher than average streamflows. The saturated ground conditions likely resulted in a much higher percentage of precipitation runoff than would typically be expected for non-saturated ground. Additionally, the saturation and the high streamflows would have caused the runoff to travel downstream much quicker, leading to higher peak streamflows within the district. While the determination of exceedance probabilities and return periods for streamflows with the District is outside the scope of this report, it is likely that these values would be even more extreme than the values determined for the precipitation discussed in the previous paragraph because of the unusual conditions leading up to the June 7th event.

3.2 Flooding Observations

As a result of the large rainfall event that occurred over the watershed on June 7, 2008, Honey Creek and several of its tributaries experienced severe flooding. In some cases, the levees that were designed and constructed to provide protection up to the 1% annual-chance-flood overtopped during the rainfall event. In addition, the relatively heavy rainfall within the District exceeded the design capacity of the interior drainage system. The combination of levee overtoppings and interior drainage problems resulted in widespread damage as a result of the flooding.

Figure 1: Overtopping of Honey Creek Levee near confluence of Jordan Creek

Flooding from the southern tributaries to Honey Creek was the most severe due to the higher precipitation values experienced in these sub-watersheds. Jordan Creek flows from the south and has its confluence with Honey Creek at approximately river mile (RM) 7.8 as seen on **Exhibit 6**. Streamflows along Jordan Creek were very high on June 7th. In addition, a small earthen dam located approximately 3.2 miles upstream of Honey Creek is reported to have breached on June 7th as a result of embankment overtopping. The failure of this dam appears to have caused additional flooding because of the surge of water that was rapidly released from the dam's reservoir. The District's tieback levee along the west side of Jordan Creek at the confluence with Honey Creek overtopped during this event. The overtopping of this levee appears to have caused widespread flooding with damage to crops as well as several homes west of the levee. The

levee along the north side of Honey Creek at the confluence of Jordan Creek was also overtopped with the resulting floodwaters traveling northward before they were presumably captured by the Middle Channel. **Figure 1** shows the overtopping of a segment of levee on the north side of Honey Creek near the confluence with Jordan Creek.

Figure 2: Floodwall overtopping from Corn Creek into Allendale Subdivision

Corn Creek is another southern tributary to Honey Creek and can also be seen on **Exhibit 6**. Rainfall depths in this sub-watershed were the most severe according to Doppler radar data. Corn Creek has its confluence with Honey Creek at RM 10.2 near the Allendale Subdivision. The Allendale subdivision is bordered by the Honey Creek levee system directly to its north as well as a tie-back levee/floodwall system along Corn Creek to its east. The subdivision is bordered by natural high ground to its south and by US 41 to the west. As a result, Allendale effectively sits in a "bathtub" and relies on a pump station to discharge storm water over the levee into Honey Creek. At some point during the June 7th event, the floodwall segment along the Corn Creek tie-back levee began overtopping into the Allendale Subdivision because of high stream flows from Corn Creek (see **Figure 2**). The overtopping floodwaters quickly overwhelmed the pump station and filled the entire "bathtub" area of the Allendale Subdivision to the point where the flood waters from the subdivision began overtopping the levee to the north back into Honey Creek. Nearly the entire subdivision, approximately one dozen homes, was inundated by as much as 8 feet of water as a result of the flooding. Operations problems with the pump station resulted in the homes remaining inundated for several days. Refer to **Appendix 2** for additional photographs of the Allendale Subdivision flooding.

Figure 3: Overtopping of levee on north bank of Honey Creek at RM 11.0

A segment of the levee along the north bank of Honey Creek between the confluence of Corn Creek and the UNT to Honey Creek (approximately RM 11.0) also experienced overtopping (see **Figure 3**). The overtopping floodwaters began to flow north towards Thompson Ditch. Many homes and businesses within the area bounded by Honey Creek to the south, US 41 to the west and Thompson Ditch to the North were damaged by floodwaters which presumably resulted, at least in part, from the overtopping of this levee segment. Although flooding in this area was severe, two factors helped to lessen both the severity and duration of the flooding. The first factor was that flows in Thompson Ditch were much less than flows in Honey Creek due to the fact the Thompson Ditch watershed extends mainly to the north. Secondly, the segment of levees/floodwalls on the south bank of Honey Creek to the east of 7th Street were under construction at the time of the flood and a large gap in the line of protection at 5th Street actually allowed floodwaters to flow into Thompson Ditch to be conveyed downstream (see **Figure 4**). Had the flows in Thompson Ditch been much higher or if the Thompson Ditch floodwall had been completed, the severity and duration of flooding in this area may have been much worse.

Figure 4: Flow entering south side of Thompson Ditch at 5th Street

Refer to **Exhibit 6** for locations of levee overtopping as well as directions of flow during the June flooding. Refer to Appendix 1 for additional photographs of the June flooding.

3.3 Comparison of Flood Profiles

Flood profiles for Honey Creek and Thompson Ditch were developed as a part of the District Plan to compare the levee crest elevation with both the pre-project and post-project 100-year water surface profiles. These figures have been annotated to indicate areas of known levee overtoppings and are included in **Appendix 3**. The flood profiles show that the post-project 100-year water surface elevation was generally increased by 1.0 foot or less over the pre-project condition. Exceptions to this degree of increase occur on Honey Creek, just downstream of Rigney Road where the increase is closer to 1.5 feet and on Thompson Ditch, just downstream of US 41 where the maximum increase is closer to 2.0 feet. The levee crest elevations were designed, and presumably have been constructed, to provide 3 feet of freeboard above the post-project 100-year flood profile elevation. As indicated in the previous section, the levees were overtopped in numerous locations which indicates that, in those locations, the flood profile for the June 7th event exceeded the 100-

year post-project flood profile by more than 3 feet.

Given the extreme precipitation values for the June 7th event, the fact that the estimated 100-year post-project flood profile was exceeded is not surprising. However, the degree by which the 100-year flood profile was exceeded is startling. While it does not appear that 500-year post project flood profiles were ever developed, the 1987 Floodplain Management Study compares pre-project 100-year and 500-year flood profiles taken from the 1981 and 1983 Flood Insurance Study (FIS). These profiles are also included in **Appendix 3.** The profiles indicate that in the locations of the levee overtoppings, the pre-project 500-year flood profile is only on the order of 1 foot or less greater than the pre-project 100-year flood profile. This seems to suggest that the June 7th flood profiles of Honey Creek, and to a greater extent, its southern tributaries, are likely to have greatly exceeded the post-project 500-year flood profile and probably the 1,000-year flood profile as well.

As noted previously, some of the most catastrophic levee overtoppings were a result of flows from the tributaries of Corn Creek and Jordan Creek. It is unclear whether detailed hydrologic and hydraulic analyses were ever completed on these tributaries. It is possible that the elevations of the tie-back levees that extend back from Honey Creek along each of these tributaries were based only on the flood profile for Honey Creek. In actuality, the flood profiles for Corn Creek and Jordan Creek are likely to be higher than the Honey Creek flood profile at the point where the levees terminate into high ground. This implies that the elevation of these tie-back levees may not be sufficient to provide 1% annual-chance-flood protection.

3.4 CBBEL Field Investigation

Following the June flooding, on October 9, 2008, CBBEL personnel met with Eddy Adams from the NRCS to view the overall levee system for Honey Creek and Thompson Ditch. Mr. Adams, who has a long history of working with the district, was onsite during the time of the June flooding and was able to show the specific locations that experienced problems during the June flooding.

Figure 5: Logjam in channel of Honey Creek

Overall, the levee structures were observed to be well maintained with adequate vegetation and no evidence of any major instabilities. Although most of the levees were not significantly damaged by the June event, there were several areas where the previous overtopping of the levee was still evident based on matted vegetation and residual debris. A few isolated areas were damaged in the June event but had been repaired prior to the field investigation.

Several significant logjams were observed at the time of the field investigation. Mr. Adams indicated that while the logjams may have moved slightly during the June event, they definitely existed prior to the June event. It was Mr. Adams opinion that the logjams may have been a major factor in the severity of the June flooding. Figure 5 displays one of the logjams observed during the field investigation.

CBBEL personnel also observed the outlet structure for the Middle Channel detention basin during the field investigation. The sluice gate for this outlet structure appeared to be left in the opened position. It was not apparent that there was any mechanism in place to lock the gate in either the open or closed position.

3.5 Willa Villa Neighborhood

The Willa Villa neighborhood is located within the District just south of East Springhill Drive approximately 0.2 miles west of McDaniel Road. The neighborhood consists of 54 homes located along South 19^{th} ½ Street and its adjacent cul-de-sacs. During the June event, all but one of the homes experienced some measure of flooding although for many of those the flooding was confined to the basement or crawl space. According to eyewitness testimony of homeowners, the source of the flooding appears to have been the result of surface flows coming across the fields to the south of the neighborhood. These surface flows were probably the result of local runoff as well as flows from the overtopping of the Honey Creek levee at RM 11.0. Significant flooding also occurred within the Willa Villa neighborhood in May of 2002.

The topography of the Willa Villa neighborhood is flat. The neighborhood is drained primarily by a system of roadside ditches and small diameter driveway culverts. The northern quarter of the subdivision appears to drain through these ditches to a culvert under Springhill Drive and then north through ditches until it eventually reaches Thompson Ditch. The southern three quarters of the neighborhood as well as a significant amount of offsite area appears to drain to a groundwater discharge pond on the east side of the neighborhood. There is no apparent surface or conduit outlet provided for the pond so ordinarily the pond must store all surface runoff until it can be slowly infiltrated through the gravely soils, recharging the groundwater. This typically provides adequate drainage for the neighborhood as long as the pond has sufficient time to recover from rainfall events. If the water surface elevation of the pond gets high enough, it will begin to drain through the roadside ditches to the culvert under Springhill Drive. Unfortunately, by the time the water surface elevation gets to this elevation, water

Figure 6: Flooding in Willa Villa from adjacent pond (taken at 10:45am on June 7^{th})

from the pond has already inundated many of the homes and a significant portion of the streets in the neighborhood.

In the 2008 flooding, the moderate intensity rainfall that had occurred in the weeks leading up to the June 7th event left the pond at well above normal levels. The rainfall and levee overtopping of June 7th caused the water surface elevation of the pond to increase even further which quickly inundated most of the homes and streets in the neighborhood. **Figure 6** shows a view of the flooding in the neighborhood during the June 7th event. In the photograph, the pond area can be seen as the large open area at the far right of the picture. Following the June 7th event, the pond took an excessive amount of time to return to its normal water surface elevation. Photographs provided by one homeowner show the pond remained above normal for at least a month following the June 7th event.

The lack of a suitable surface or conduit outlet for the pond adjacent to Willa Villa appears to be the most significant factor in the recurring flooding that has occurred there. Insufficient capacity of the ditches and culverts that convey the flow from the northern boundary of the neighborhood to Thompson Ditch may have also contributed to the problem. Additional analysis is required to determine whether these ditches and culverts have adequate capacity and to determine the feasibility of providing an adequate surface or conduit outlet for the pond. The reduction of offsite flows to Willa Villa from the south should also be considered as a means of reducing the severity of future flooding in Willa Villa. It appears that the previously mentioned East Channel that was proposed in the District Plan to improve interior drainage would aid in this endeavor.

4.0 Conclusions and Recommendations

4.1 Conclusions

The following conclusions are made based on a review of the available data and the investigation of the June 7th flood event.

1. The District Plan anticipated that further residential and commercial development would take place within the District and that this development would impact the hydrologic characteristics of the District. It appears that the assumptions made in the original District Plan regarding residential and commercial development reasonably anticipated the changes that have taken place to date within the District. The Plan appears to have accounted for the impacts of the development in the interior drainage analysis but not necessarily in the development of the flood profiles that were used to establish the levee crest elevations.

2. The District Plan did not anticipate the construction of the major roadway bypass around the east side of the District known as State Road 641. The construction of this road involves extensive earthwork and drainage structures. The impacts of this project on the District's flood control efforts have not been analyzed.

3. According to the District Plan, the levees along Honey Creek and Thompson Ditch were designed to provide flood protection up to the 1% annual-chance flood with at least 3 feet of freeboard. This design criteria is similar to the minimum requirements that the Federal Emergency Management Agency (FEMA) has for determining whether properties protected by a levee system should have their hazard level reduced from high to moderate on their Flood Insurance Rate Maps (FIRMs).
4. Current FEMA criteria require that in order to be recognized as providing protection from the 1% annual-chance-flood, levees must provide freeboard of up to 4 feet in certain key areas such as just upstream of bridges and at the upstream end of the levee system. As a result, the levees as they are currently constructed, may not be eligible for recognition by FEMA which would prevent many areas within the District from being reduced from high to moderate risk on the FEMA FIRMs.
5. The construction of levees and interior drainage components to date appears to have closely paralleled the recommendations made in the original District Plan in terms of both location and dimension. Significant components that have not yet been completed include some of the levees along Thompson Ditch as well as the East Channel.
6. It appears that the flooding of June 7, 2008 was primarily the result of an extreme rainfall event that far exceeded the design storm for which the levees were originally designed. As a result, it is likely that significant flood damage would have occurred even if all of the proposed District Plan flood control components had been completed prior to the June 7th event.
7. Other than providing levee freeboard, the District Plan does not appear to contain any measures for mitigating flood damage in the event of levee overtoppings.

4.2 Recommendations

The following recommendations are provided for moving forward with District's role in providing flood control and prevention measures in the lower Honey Creek watershed. The order of the recommendations below does not necessarily reflect the priority or sequence of implementation.

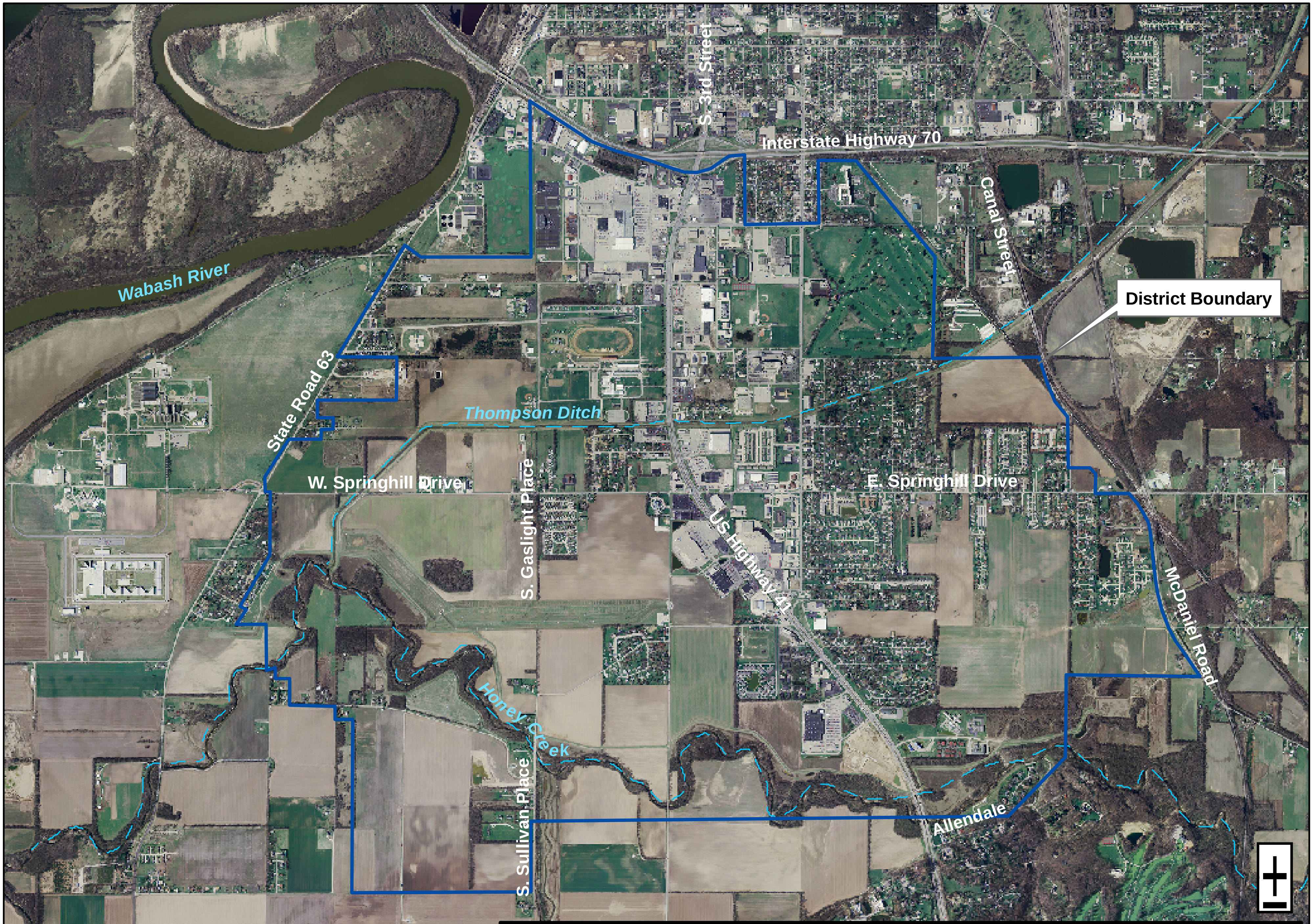
1. Initiate a study to determine the best combination of structural and non-structural measures that can be implemented or expanded to minimize the risk of flood damages within the District both now and in the future. Applicable non-structural measures could include improved stormwater ordinances that include No Adverse Impact (NAI) policies, flood warning systems, evacuation plans, development restrictions, and property buyouts. Such a study would help account for the impact of more development in the watershed for future adequacy of the levee system by factoring in the impact of regulatory policies on physical infrastructure. This study should involve a jurisdictional approach with outreach to and involvement of the public.

2. Perform a feasibility study to develop and analyze alternatives for mitigating levee overtoppings during flood events that exceed the design criteria. This could include the use of additional storage basins and interior drainage channels to safely store and convey floodwaters from designated levee overtopping locations. The use of flood control gates in the Thompson Ditch floodwall should also be considered to allow floodwaters from Honey Creek to discharge into Thompson Ditch.
3. Initiate a hydrologic and hydraulic analysis to estimate 100-year and 500-year flood profiles for Corn Creek and Jordan Creek. Using these profiles, determine whether the existing tie-back levees along these tributaries offer adequate protection.
4. Prepare a system-wide operations and maintenance (O&M) manual for the levee system and interior drainage components. The O&M manual should address such things as the operation procedures of any mechanical equipment, inspection schedules, vegetation control procedures, and guidance for flood fighting efforts. It is important that this manual specifically assign responsibility for opening and closing any mechanical gates that need to be operated during a flood.
5. Initiate a process to determine whether the risk level associated with the current levee design criteria of providing protection from the 1% annual-chance-flood is appropriate for the District. This process should include consultation with legal and engineering experts to evaluate the cost to benefit ratio of improving the levee system beyond the current design criteria. Public outreach and involvement would also be a key aspect of this process.
6. Depending on the outcome of the recommendation above, consider improving the levees to meet current FEMA requirements which would entail adding up to one foot of additional freeboard in areas considered to be especially vulnerable. This would make many areas in the district eligilble for being reduced from high risk flood zones to moderate risk flood zones, which would serve to lower flood insurance premiums. Note that if the above recommendation results in a decision to raise the overall level of design criteria for the levee system, this recommendation may not be necessary.
7. Perform a hydrologic analysis to evaluate the impacts that the ongoing construction of State Road 641 is having on the interior drainage of the District. This analysis should consider whether the alignment and size of the East Channel is still appropriate based on the impacts of State Road 641.
8. Perform a feasibility study for providing an adequate outlet for the Willa Villa pond. This study should include a capacity analysis of the downstream receiving ditch to the north of Springhill Drive. This analysis should also consider the potential benefits that the East Channel may provide to Willa Villa and whether the East Channel or its associated detention basin may provide a suitable discharge point for the pond outlet.

9. Remove the logjams from Honey Creek and implement a program, including funding mechanisms, to continuously inspect for and promptly remove all future logjams. The District should consider partnering with the County and/or NRCS to develop their logjam removal program and determine appropriate responsibility of parties involved.

10. Only after completing analyses recommended above, proceed with the design and construction of the remaining flood control components recommended by the District Plan. The order that the remaining components are constructed in should be evaluated based on a determination of which remaining components will provide the most benefit.

Exhibits

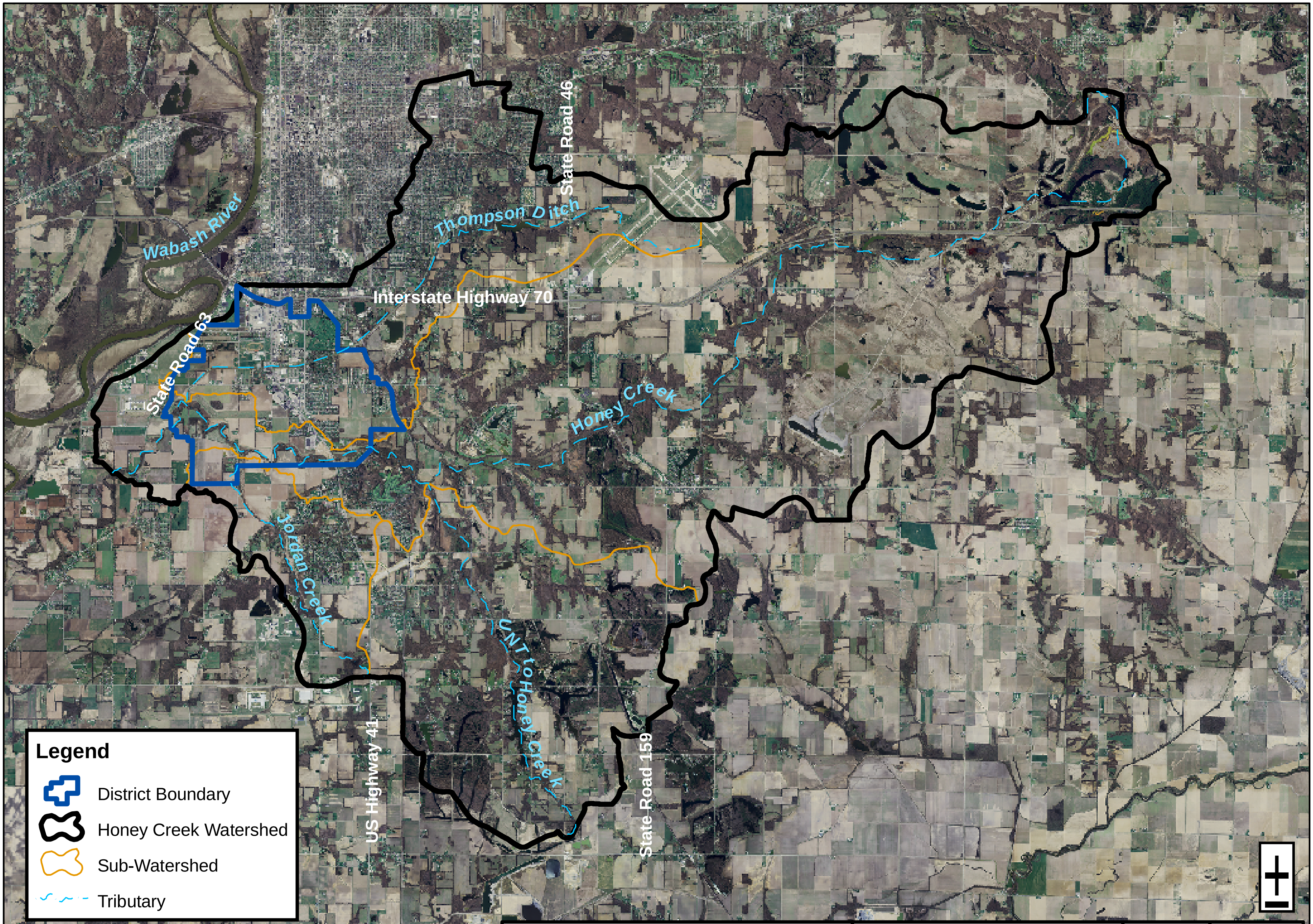


Sources of Data:

1. Aerial Photography: 2005 Indiana Orthophotography, IndianaMap Framework Data (www.indianamap.org).

Christopher B. Burke Engineering, Ltd.
National City Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT:	PROJECT NO.	APPROX. SCALE
Honey Creek District - Plan Evaluation	08-0454	1"= 2500'
TITLE: Location Map - Honey Creek Conservancy District		DATE: 1/09
		EXHIBIT 1

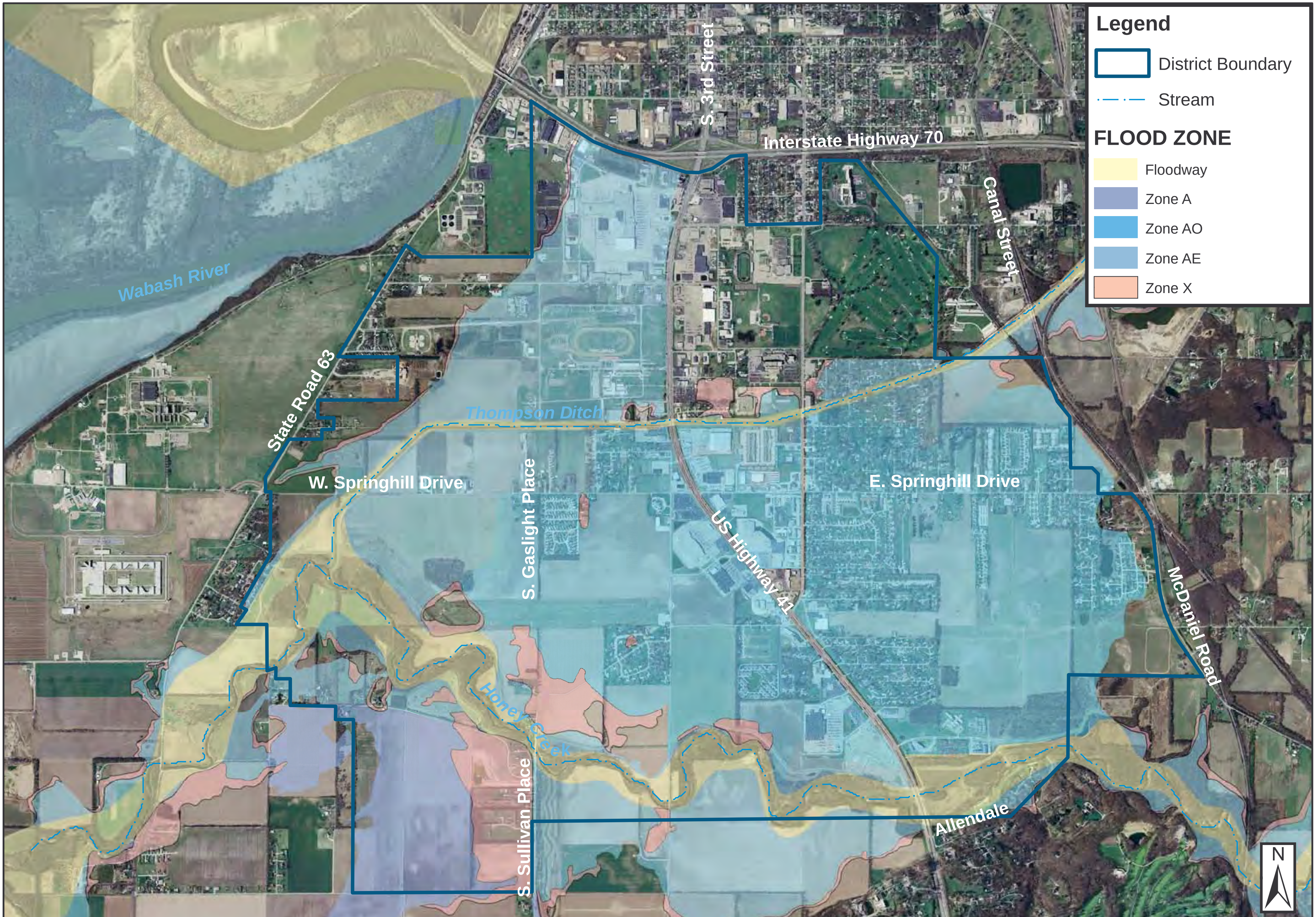


Sources of Data:

1. Aerial Photography: 2005 Indiana Orthophotography, IndianaMap Framework Data (www.indianamap.org).

Christopher B. Burke Engineering, Ltd.
National City Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT:	PROJECT NO.	APPROX. SCALE
Honey Creek District - Plan Evaluation	08-0454	1"= 10000'
TITLE: Honey Creek Watershed		DATE: 1/09
		EXHIBIT 2

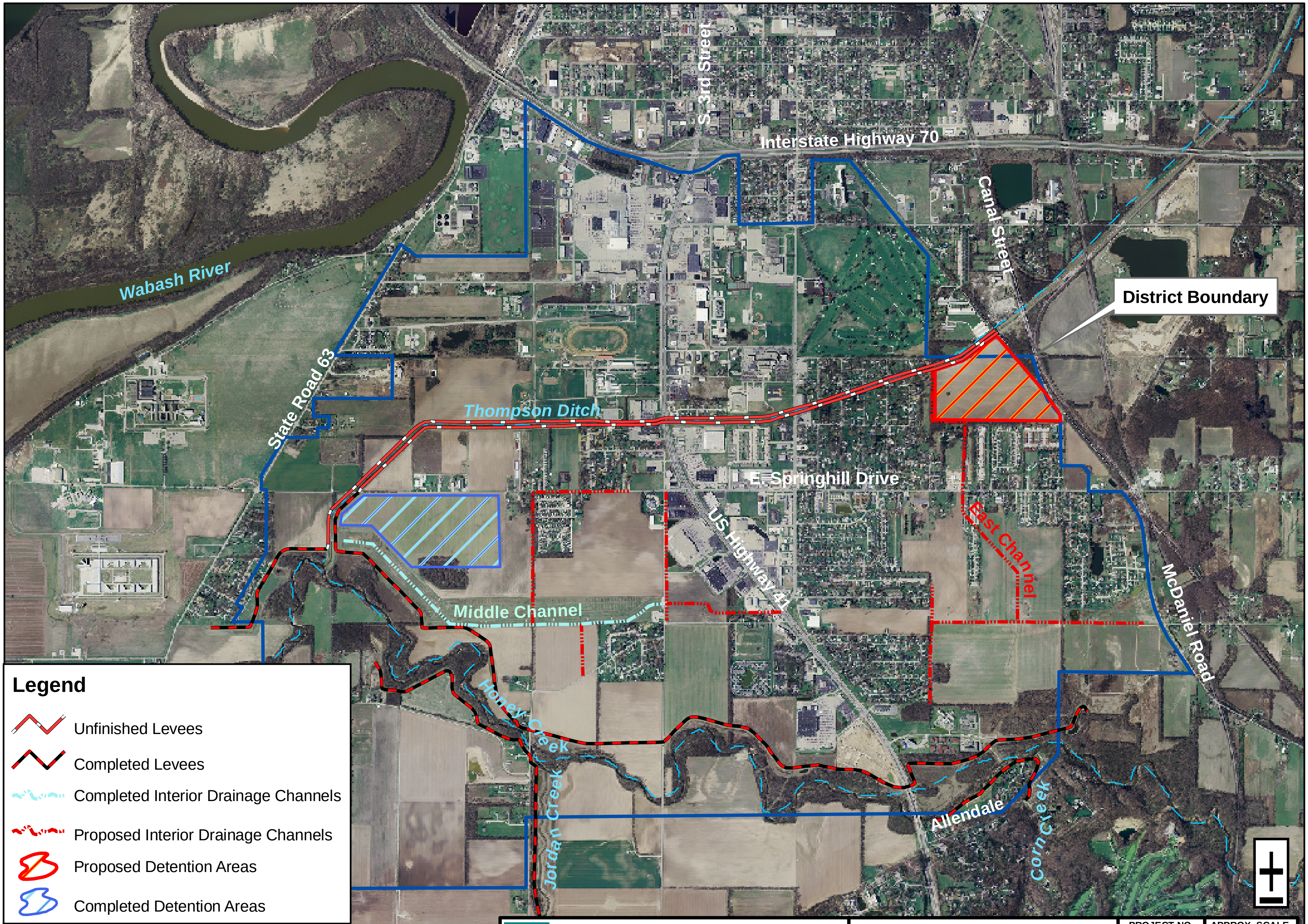


Sources of Data:

1. Aerial Photography: 2005 Indiana Orthophotography, IndianaMap Framework Data (www.indianamap.org).

Christopher B. Burke Engineering, Ltd.
National City Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT: Honey Creek District - Plan Evaluation	PROJECT NO. 08-0454	APPROX. SCALE 1"= 2500'	
TITLE: Floodway and Floodplain Mapping		DATE: 1/09	EXHIBIT 3

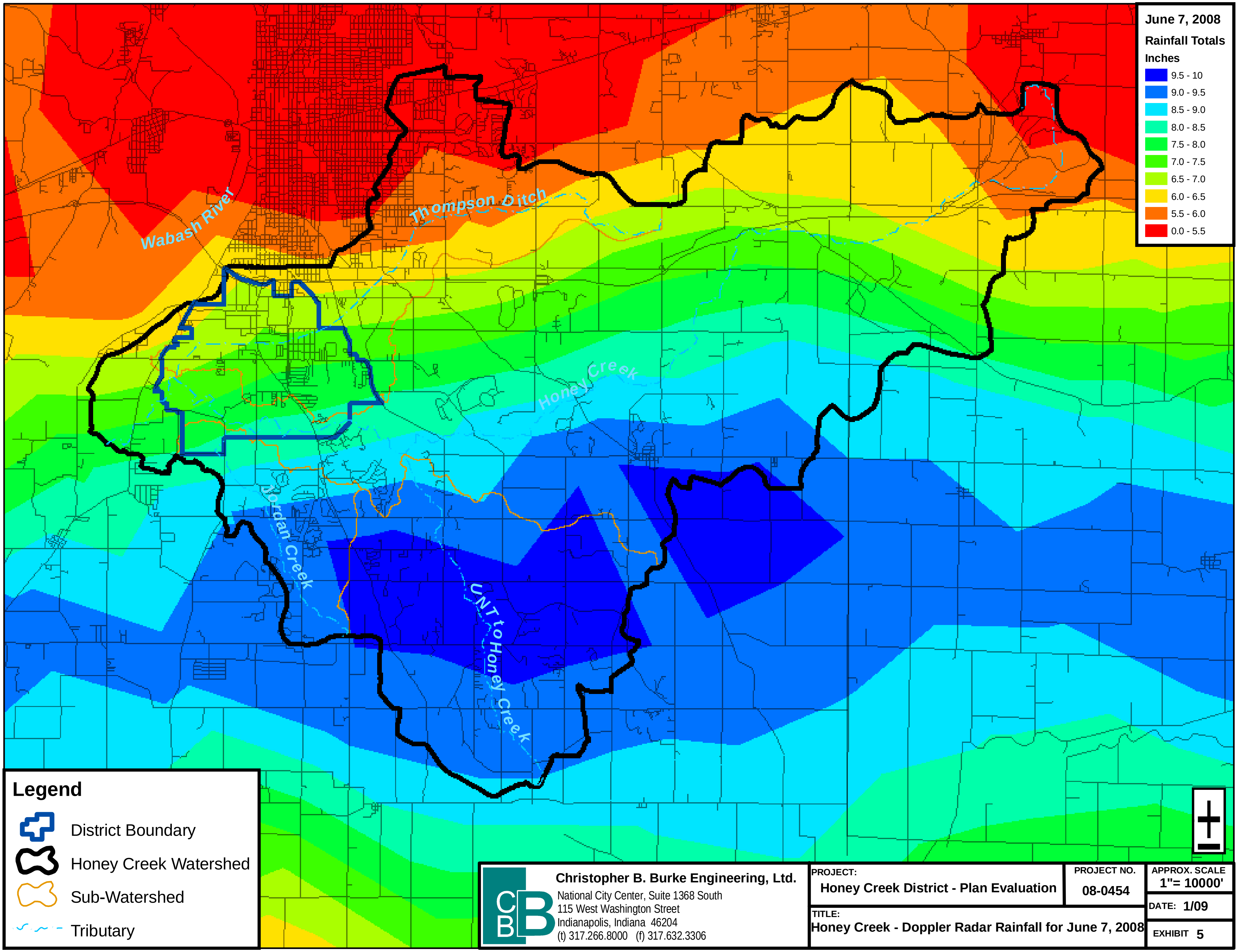


Sources of Data:

1. Aerial Photography: 2005 Indiana Orthophotography, IndianaMap Framework Data (www.indianamap.org).

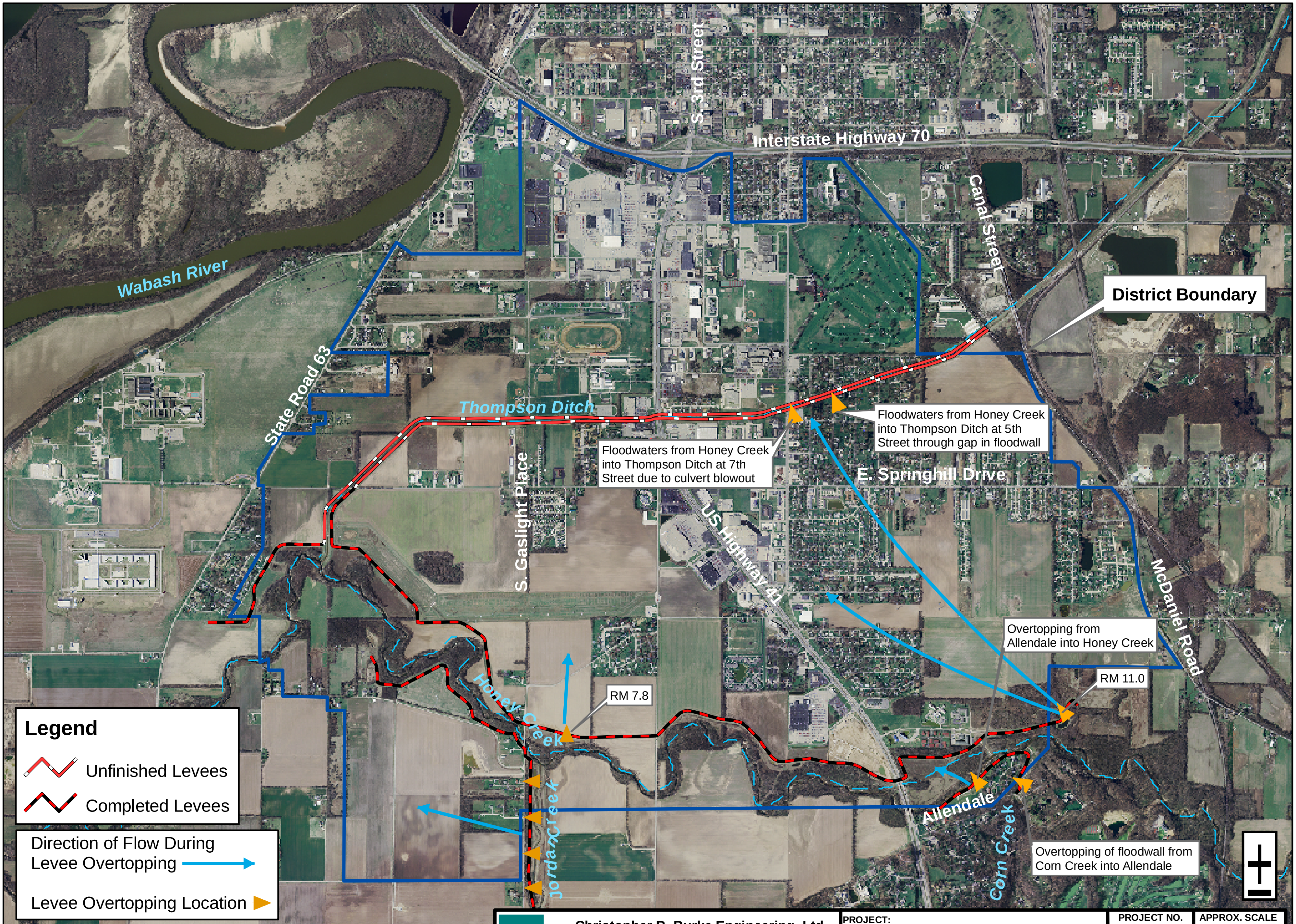
Christopher B. Burke Engineering, Ltd.
National City Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT:	PROJECT NO.	APPROX. SCALE
Honey Creek District - Plan Evaluation	**08-0454**	**1"= 2500'**
TITLE: **Flood Control and Interior Drainage Components**		DATE: **1/09**
		EXHIBIT **4**



Christopher B. Burke Engineering, Ltd.
National City Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT: Honey Creek District - Plan Evaluation	PROJECT NO. 08-0454
APPROX. SCALE	1"= 10000'
DATE:	1/09
TITLE: Honey Creek - Doppler Radar Rainfall for June 7, 2008	EXHIBIT 5



Sources of Data:

1. *Aerial Photography: 2005 Indiana Orthophotography, IndianaMap Framework Data (www.indianamap.org).*

Christopher B. Burke Engineering, Ltd. National City Center, Suite 1368 South 115 West Washington Street Indianapolis, Indiana 46204 (t) 317.266.8000 (f) 317.632.3306	PROJECT: **Honey Creek District - Plan Evaluation**	PROJECT NO. **08-0454**	APPROX. SCALE **1"= 2500'** DATE: **1/09**
	TITLE: **Overtopping Locations and Flow Direction During June 2008 Flooding**		EXHIBIT **6**

Appendix 1 – Photos of June Flooding

Photo 1: Aerial photograph of flooding of Honey Creek of SR 63.

Photo 2: Flooding of a neighborhood near Honey Creek downstream of SR 63

Photo 3: Looking along floodwall just west of the confluence of Jordan Creek and Honey Creek near Rigney Road during October 9, 2008 CBBEL site investigation.

Photo 4: Looking at floodwall shown in Photo 3 during June flood event.

Photo 5: Looking at culvert washout from Jordan Creek Overflow.

Photo 6: View of Allendale homes being flooded by Corn Creek. Floodwall is being overtopped in foreground of photograph.

Photo 7: View of car in Allendale neighborhood with inundated home in background.

Photo 8: View of home flooded in Allendale neighborhood.

Photo 9: Looking north towards home just south of Honey Creek near Allendale neighborhood.

Photo 10: Looking south from levee towards the US Highway bridge over Honey Creek.

Photo 11: Looking east along levee north of Honey Creek (RM 11.0). Levee is overtopping in background.

Photo 12: View of levee culvert blowout just east of 7th Street.

Photo 13: Photo of levee culvert blowout just east of 7th Street taken after significant erosion has taken place.

Photo 14: Floodwaters from Honey Creek discharging into Thompson ditch through gap in floodwall.

June 7, 2008 Observations of Honey Creek Flooding
Provided by: Denise Held, NRCS
Pictures by: Denise Held and Eddy Adams

On the evening of Friday, June 6th through the morning of Saturday, June 7th, 2008, there was significant rainfall throughout Vigo County. Local reports from local folks include 10 inches in less than 12 hours near the town of Riley while another report indicates 12.2 inches just east of 7th Street and south of Springhill Road.

On the afternoon of Saturday, June 7, 2008, I observed the following:

1. Allendale - Overtopping of the west end of the dike from the protected side moving over the dike and into Honey Creek. Picture taken at 3:17 p.m.

2. Allendale at Country Club Road and Corn Creek overtopping the guard rail and concrete floodwall. Pictures taken by Eddy Adams by kayak around late a.m.

3. Allendale just downstream confluence of Honey Creek and Corn Creek overtopping concrete floodwall along Honey Creek. Picture taken by Eddy Adams by kayak around late a.m.

4. Honey Creek floodplain north of creek and east of US41 near twin 36” dia pipes looking upstream (east). Note overtopping in foreground. Picture taken at 3:43 p.m.

Honey Creek was overtopping the dike north of the creek and east of Rigney Road as well as the majority of what we call the Jordan Ditch Dike. There was damage but no overtopping of the Honey Creek dike to the west of Sullivan Place/Rigney Road.

Other Notes:

1. Flood water was observed leaving Thompson Ditch at Springhill Road on the west side of Thompson Ditch. This opening and the opening just upstream Springhill Road attributed to flooding of Oak Grove.
2. Observed break in Thompson Ditch dike at Pino's just east of 7th Street on north side of Thompson Ditch. Water was coming through the subdivisions from the south and heading north to get into Thompson Ditch.

Appendix 2 – Point Precipitation Frequency Estimates from NOAA Atlas 14

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Indiana 39.398 N 87.423 W 485 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2004

Extracted: Tue Jan 6 2009

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Docs | Return to St

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.40	0.61	0.75	0.99	1.22	1.43	1.52	1.83	2.16	2.59	3.04	3.44	4.03	4.57	6.26	7.71	9.67	11.56
2	0.47	0.73	0.90	1.20	1.47	1.73	1.84	2.21	2.60	3.10	3.64	4.11	4.82	5.46	7.43	9.10	11.38	13.59
5	0.56	0.87	1.07	1.46	1.83	2.17	2.32	2.78	3.23	3.81	4.44	5.01	5.82	6.55	8.81	10.62	13.18	15.63
10	0.63	0.97	1.20	1.66	2.12	2.53	2.71	3.25	3.76	4.39	5.07	5.71	6.59	7.37	9.85	11.77	14.51	17.13
25	0.72	1.11	1.37	1.93	2.50	3.04	3.27	3.94	4.50	5.20	5.93	6.67	7.59	8.43	11.20	13.24	16.19	19.00
50	0.80	1.21	1.49	2.14	2.81	3.46	3.75	4.51	5.13	5.86	6.62	7.43	8.36	9.24	12.21	14.33	17.45	20.37
100	0.87	1.31	1.62	2.34	3.13	3.91	4.26	5.14	5.80	6.55	7.31	8.20	9.11	10.02	13.19	15.38	18.63	21.66
200	0.94	1.41	1.75	2.55	3.46	4.39	4.81	5.83	6.52	7.27	8.02	8.98	9.86	10.79	14.14	16.38	19.75	22.87
500	1.04	1.53	1.91	2.84	3.92	5.09	5.61	6.82	7.55	8.28	8.98	10.05	10.83	11.78	15.35	17.64	21.13	24.34
1000	1.12	1.63	2.04	3.05	4.29	5.66	6.28	7.66	8.40	9.08	9.72	10.87	11.55	12.51	16.23	18.56	22.13	25.38

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval
Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.43	0.67	0.82	1.09	1.33	1.57	1.68	2.05	2.40	2.80	3.26	3.68	4.30	4.87	6.66	8.17	10.22	12.18
2	0.51	0.80	0.98	1.31	1.61	1.90	2.03	2.47	2.89	3.36	3.90	4.40	5.15	5.82	7.91	9.65	12.02	14.30
5	0.61	0.95	1.17	1.60	2.01	2.38	2.56	3.10	3.59	4.13	4.76	5.36	6.22	6.97	9.37	11.26	13.92	16.45
10	0.69	1.06	1.31	1.82	2.31	2.78	2.98	3.62	4.16	4.75	5.44	6.12	7.04	7.85	10.48	12.48	15.34	18.04
25	0.79	1.21	1.50	2.11	2.74	3.33	3.60	4.38	4.99	5.63	6.38	7.15	8.13	8.99	11.94	14.05	17.15	20.03
50	0.87	1.32	1.64	2.34	3.08	3.80	4.12	5.01	5.67	6.35	7.13	7.99	8.96	9.88	13.04	15.25	18.50	21.51
100	0.95	1.43	1.78	2.57	3.43	4.29	4.68	5.71	6.41	7.12	7.91	8.85	9.81	10.75	14.13	16.40	19.79	22.91
200	1.03	1.54	1.92	2.80	3.80	4.83	5.30	6.48	7.22	7.93	8.72	9.73	10.65	11.62	15.19	17.51	21.04	24.25
500	1.15	1.69	2.11	3.13	4.33	5.62	6.21	7.62	8.40	9.09	9.85	10.97	11.78	12.77	16.60	18.97	22.64	25.94
1000	1.24	1.81	2.26	3.38	4.75	6.28	6.99	8.58	9.38	10.04	10.74	11.96	12.65	13.63	17.67	20.06	23.84	27.15

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval
Precipitation Frequency Estimates (inches)

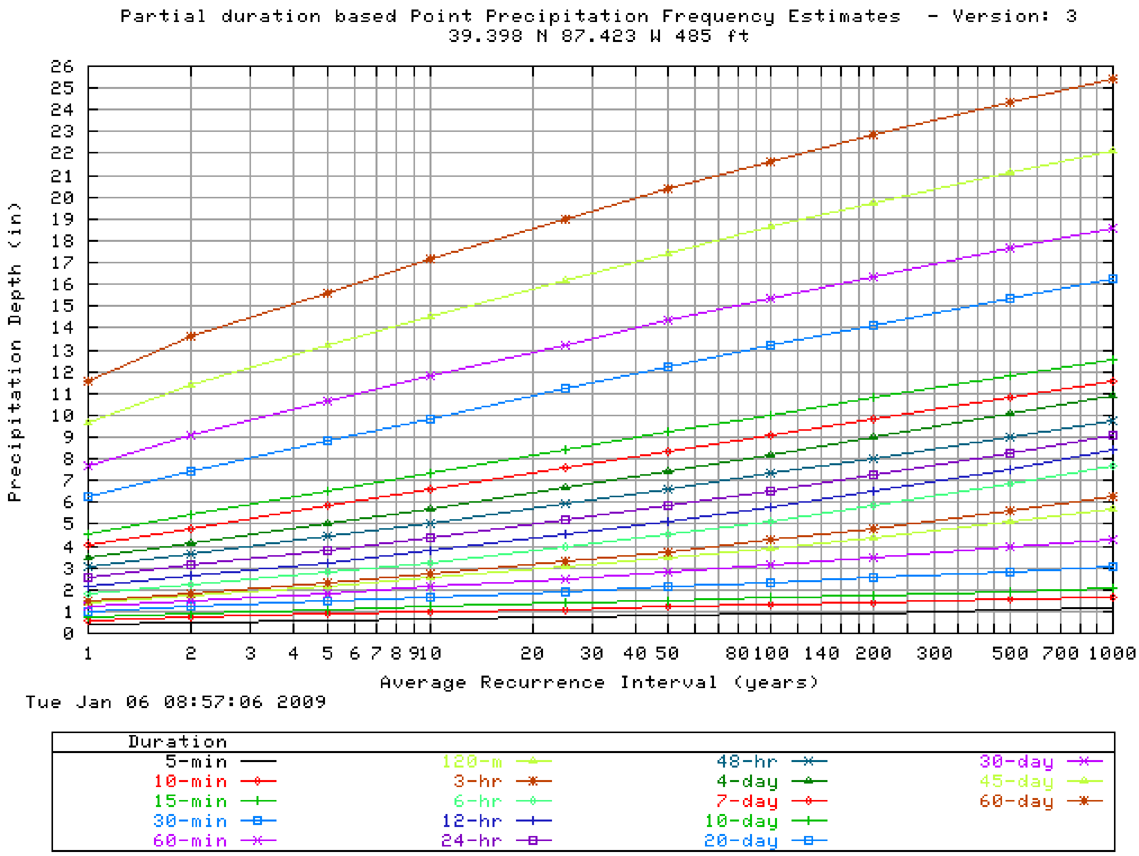
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.36	0.56	0.69	0.91	1.11	1.31	1.39	1.66	1.97	2.39	2.83	3.22	3.77	4.30	5.89	7.29	9.15	10.94
2	0.43	0.67	0.82	1.10	1.34	1.58	1.68	2.01	2.37	2.86	3.39	3.85	4.50	5.13	6.98	8.60	10.77	12.87
5	0.51	0.79	0.97	1.33	1.68	1.98	2.11	2.52	2.94	3.52	4.13	4.67	5.44	6.14	8.27	10.03	12.46	14.79
10	0.57	0.89	1.09	1.51	1.93	2.30	2.45	2.94	3.41	4.04	4.71	5.32	6.14	6.90	9.23	11.09	13.69	16.18
25	0.66	1.00	1.24	1.75	2.27	2.74	2.94	3.52	4.06	4.76	5.48	6.17	7.05	7.87	10.45	12.44	15.24	17.89

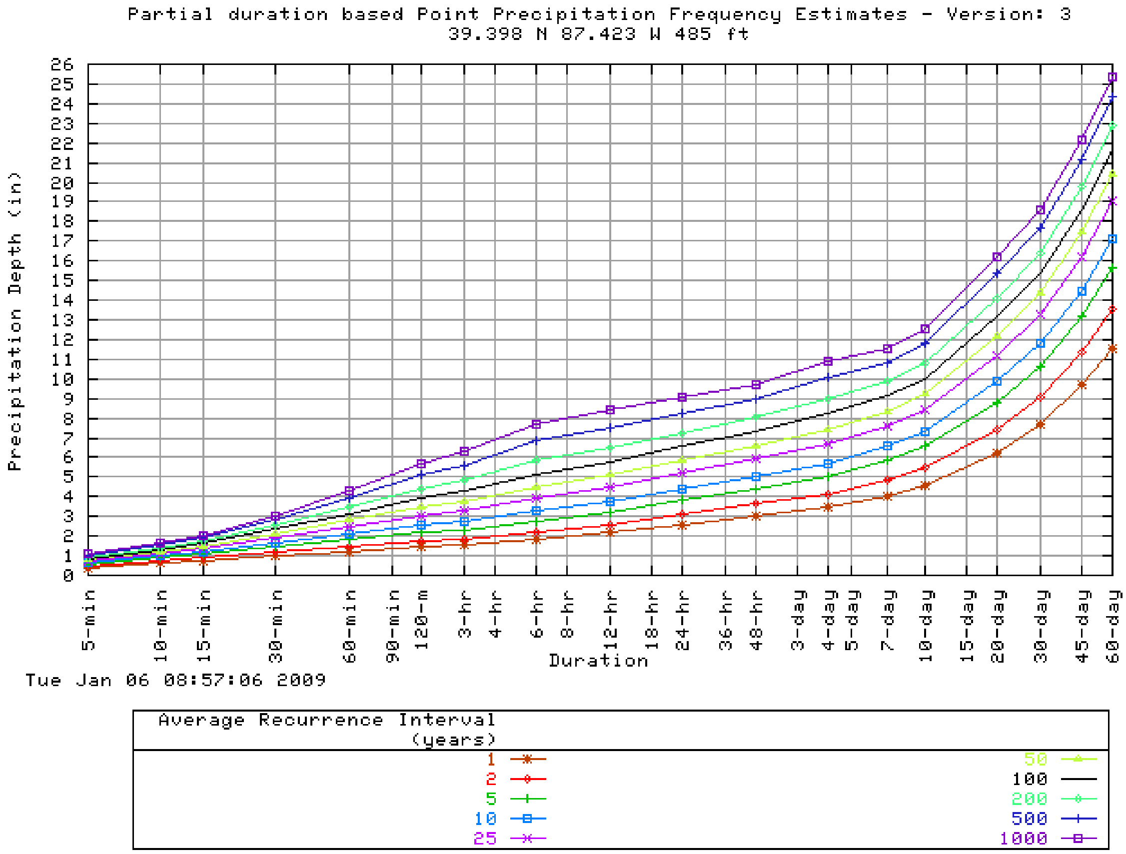
50	0.72	1.08	1.34	1.92	2.53	3.10	3.34	4.00	4.59	5.33	6.08	6.85	7.73	8.59	11.36	13.42	16.37	19.14
100	0.77	1.17	1.45	2.09	2.80	3.47	3.76	4.51	5.14	5.92	6.67	7.51	8.38	9.28	12.22	14.35	17.42	20.29
200	0.83	1.25	1.55	2.26	3.07	3.86	4.19	5.05	5.72	6.52	7.27	8.17	9.02	9.94	13.03	15.23	18.39	21.33
500	0.91	1.34	1.67	2.48	3.43	4.41	4.81	5.81	6.53	7.33	8.06	9.03	9.83	10.77	14.05	16.29	19.57	22.58
1000	0.97	1.41	1.76	2.64	3.71	4.84	5.30	6.42	7.17	7.96	8.64	9.68	10.40	11.36	14.77	17.05	20.39	23.44

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.
** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

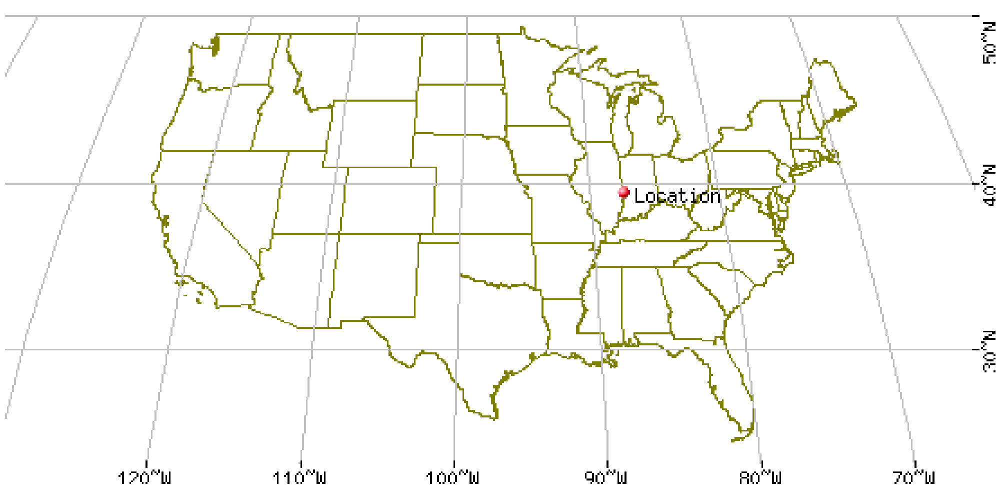
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables



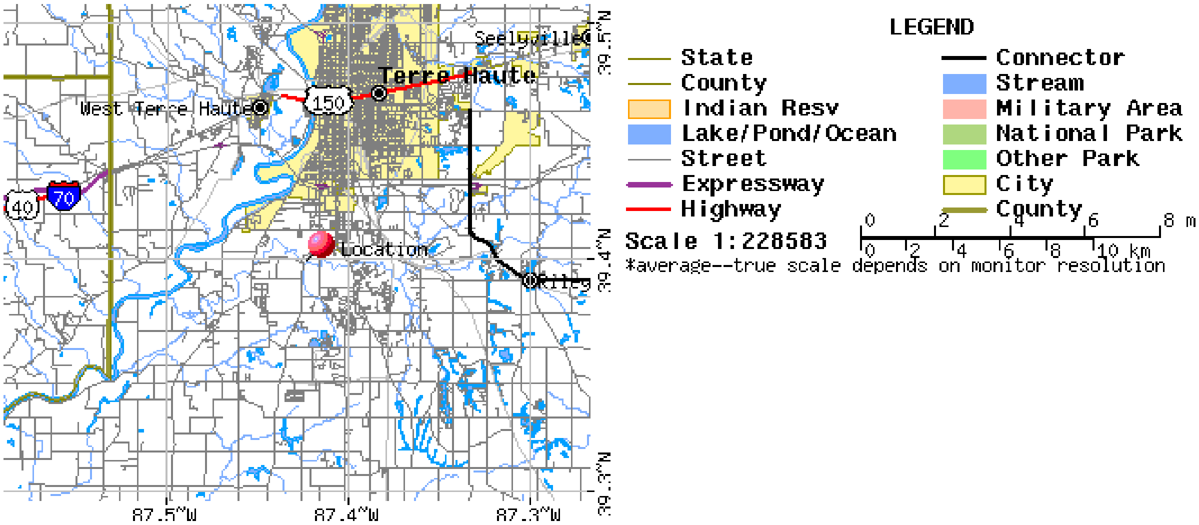


Maps -



These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources **Tiger Map Server**.

Please read disclaimer for more information.



Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; **USGS Aerial Photograph** may also be available
from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information
about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study,
please refer to NOAA Atlas 14 Document.

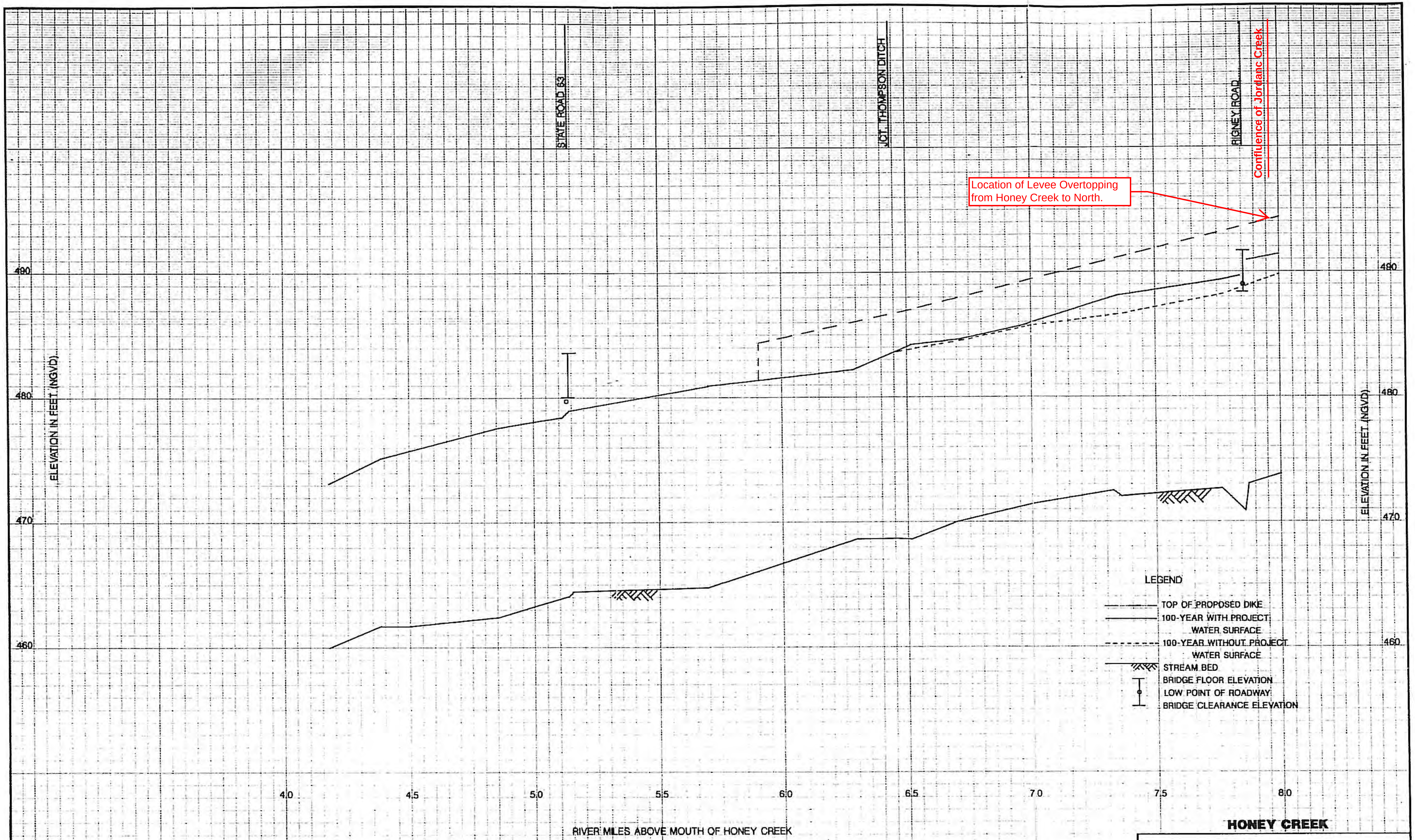
Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (39.398/-87.423). Digital ASCII data can be obtained directly from **NCDC**.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910

(301) 713-1669
Questions?: HDSC.Questions@noaa.gov

Appendix 3 - Annotated Flood Profiles



HONEY CREEK

PROFILES

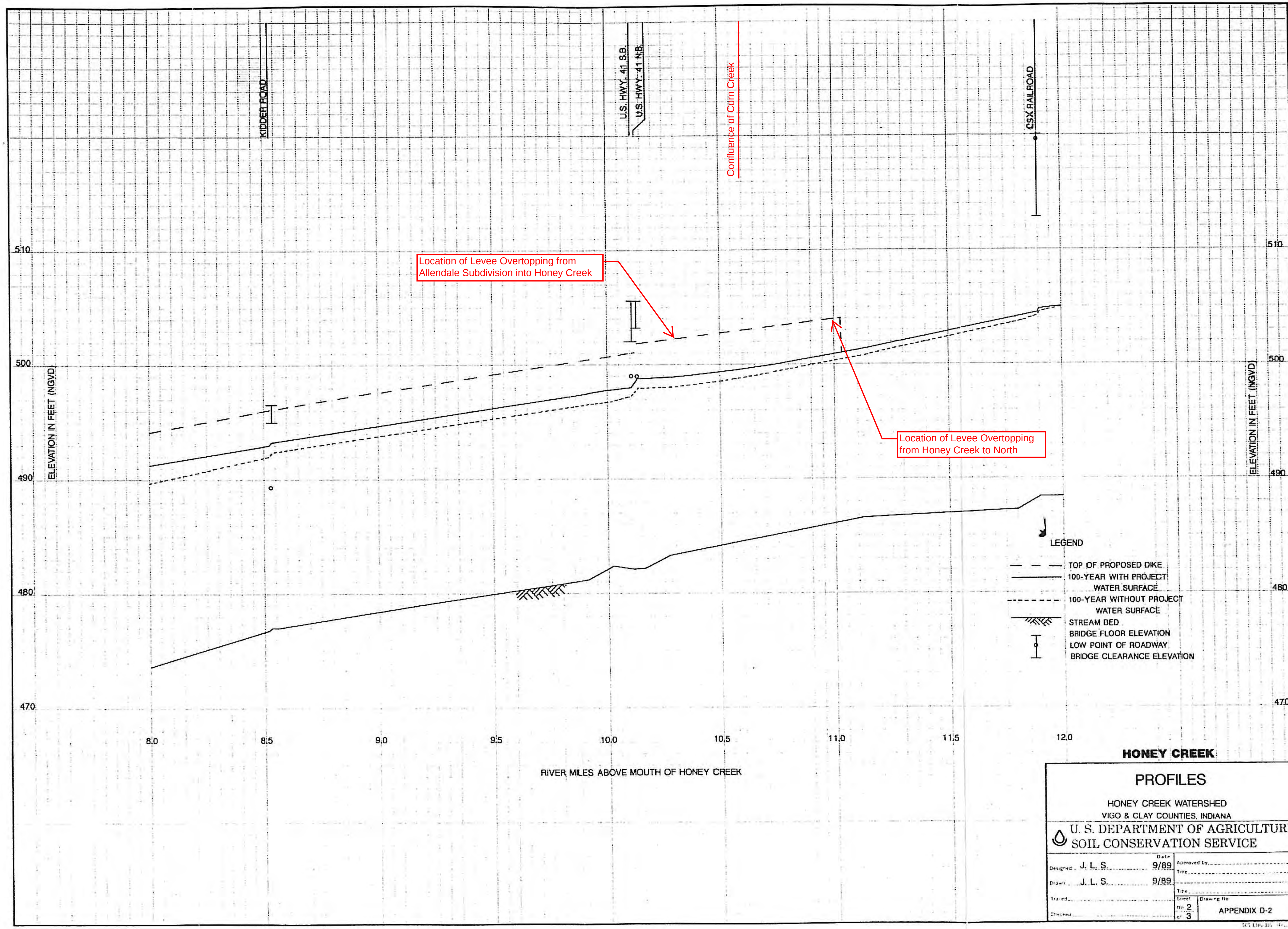
HONEY CREEK WATERSHED

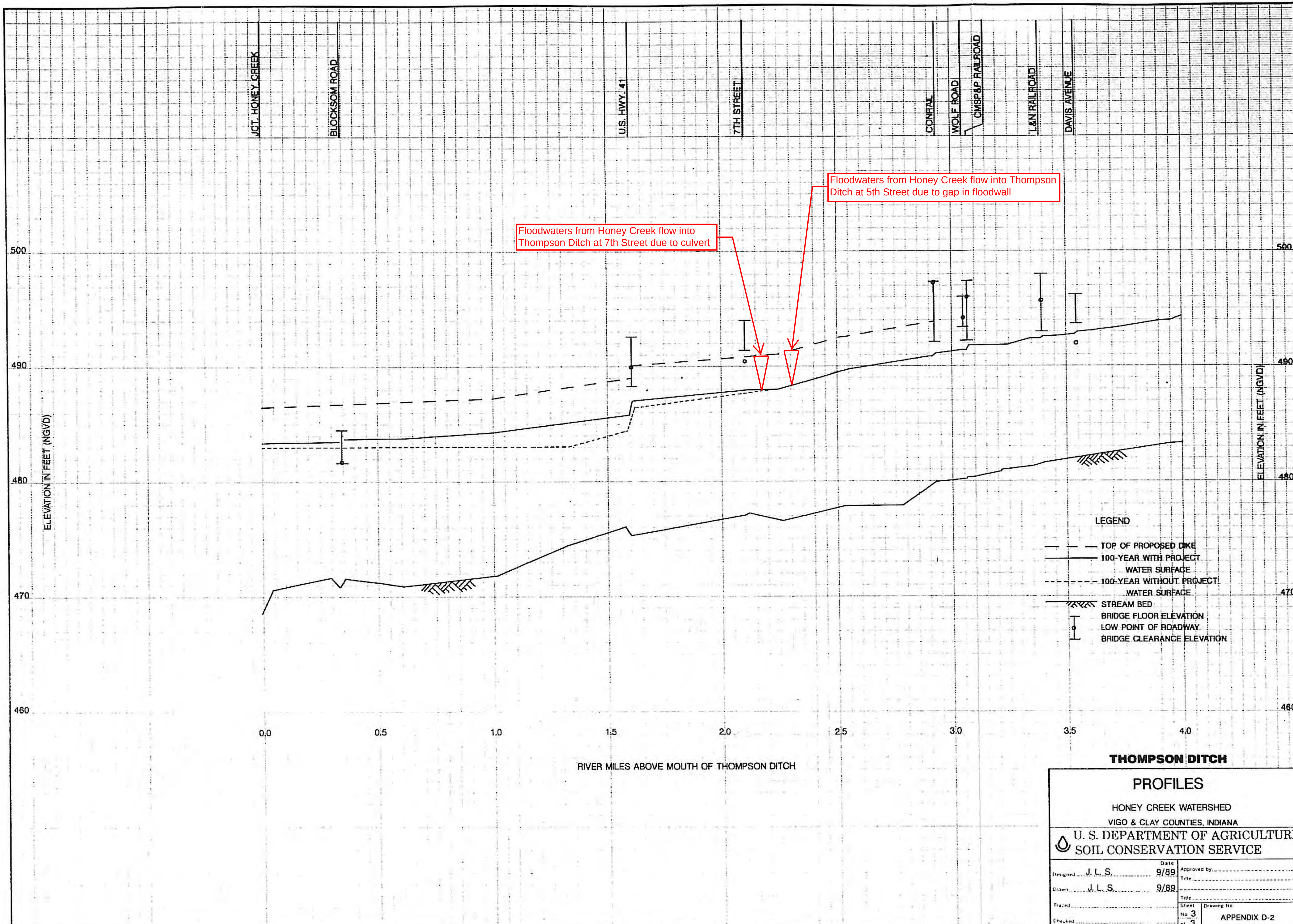
VIGO & CLAY COUNTIES, INDIANA

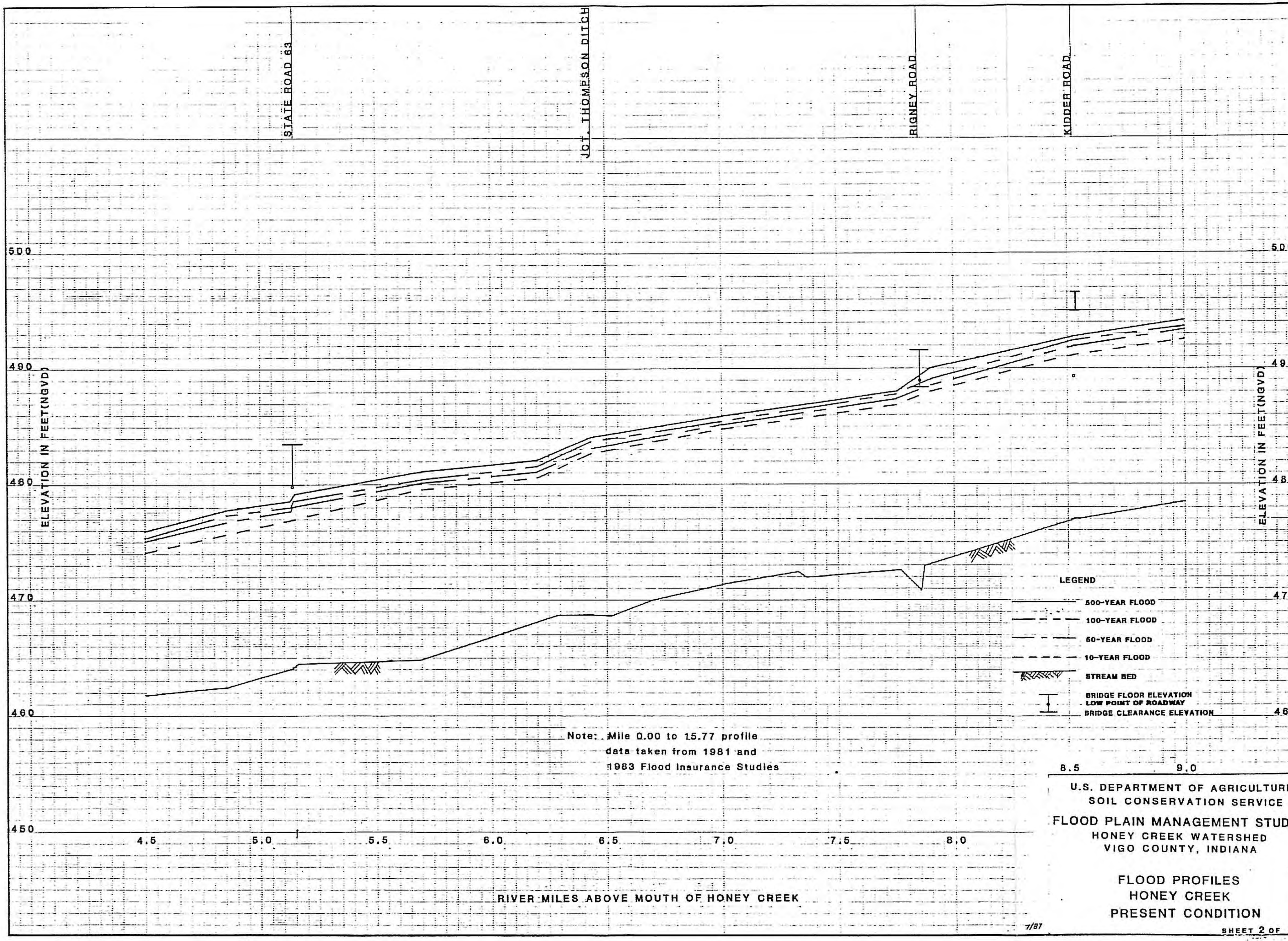
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

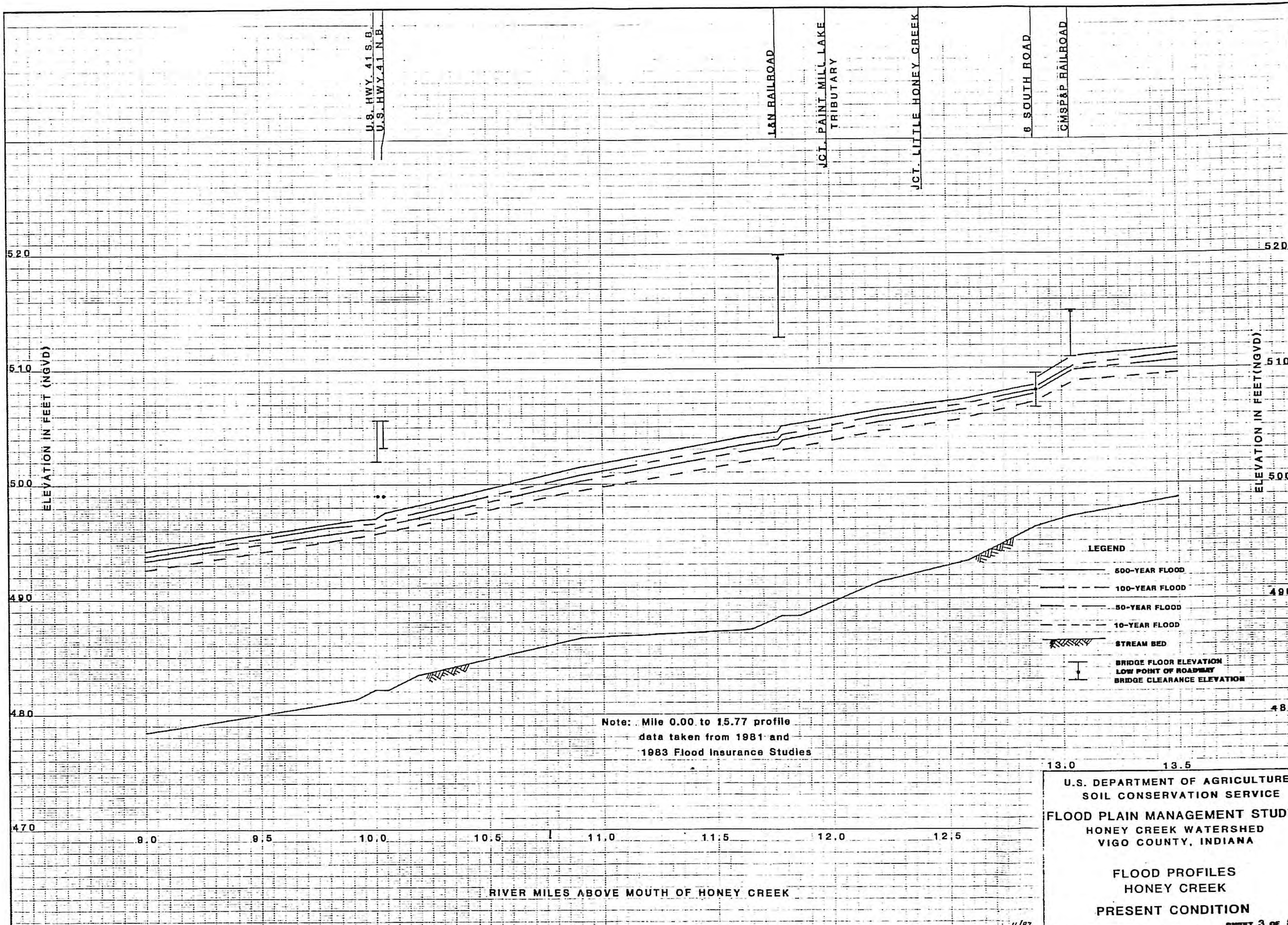
Designed J. L. S.	Date 9/89	Approved by
Drawn J. L. S.	9/89	Title
Traced		Title
Checked	Sheet No. 1 of 3	Drawing No. APPENDIX D-2

SCS-ENG-316 (Rev. 6-75)


KIDDER ROAD
U.S. HWY. 41 S.B.
U.S. HWY. 41 N.B.
Confluence of Corn Creek
CSX RAILROAD
Location of Levee Overtopping from Allendale Subdivision into Honey Creek
Location of Levee Overtopping from Honey Creek to North
ELEVATION IN FEET (NGVD)
510
500
490
480
470
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
RIVER MILES ABOVE MOUTH OF HONEY CREEK
LEGEND
TOP OF PROPOSED DIKE
100-YEAR WITH PROJECT WATER SURFACE
100-YEAR WITHOUT PROJECT WATER SURFACE
STREAM BED
BRIDGE FLOOR ELEVATION
LOW POINT OF ROADWAY
BRIDGE CLEARANCE ELEVATION
HONEY CREEK
PROFILES
HONEY CREEK WATERSHED
VIGO & CLAY COUNTIES, INDIANA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J. L. S. 9/89
Drawn J. L. S. 9/89
Traced
Checked
Approved by
Title
Sheet No. 2 of 3
Drawing No. APPENDIX D-2


JCT. HONEY CREEK
BLOCKSOM ROAD
U.S. HWY. 41
7TH STREET
CONRAIL
WOLF ROAD
CMSP&P RAILROAD
L&N RAILROAD
DAVIS AVENUE
Floodwaters from Honey Creek flow into Thompson Ditch at 5th Street due to gap in floodwall
Floodwaters from Honey Creek flow into Thompson Ditch at 7th Street due to culvert
ELEVATION IN FEET (NGVD)
500
490
480
470
460
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
RIVER MILES ABOVE MOUTH OF THOMPSON DITCH
LEGEND
TOP OF PROPOSED DIKE
100-YEAR WITH PROJECT WATER SURFACE
100-YEAR WITHOUT PROJECT WATER SURFACE
STREAM BED
BRIDGE FLOOR ELEVATION
LOW POINT OF ROADWAY
BRIDGE CLEARANCE ELEVATION
THOMPSON DITCH
PROFILES
HONEY CREEK WATERSHED
VIGO & CLAY COUNTIES, INDIANA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J. L. S. Date 9/89
Drawn J. L. S. 9/89
Traced
Checked
Approved by
Title
Title
Sheet No. 3 of 3
Drawing No. APPENDIX D-2


STATE ROAD 63
JCT. THOMPSON DITCH
RIGNEY ROAD
KIDDER ROAD
500
490
480
470
460
450
ELEVATION IN FEET(NGVD)
LEGEND
500-YEAR FLOOD
100-YEAR FLOOD
50-YEAR FLOOD
10-YEAR FLOOD
STREAM BED
BRIDGE FLOOR ELEVATION
LOW POINT OF ROADWAY
BRIDGE CLEARANCE ELEVATION
Note: Mile 0.00 to 15.77 profile
data taken from 1981 and
1983 Flood Insurance Studies
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
RIVER MILES ABOVE MOUTH OF HONEY CREEK
7/87
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FLOOD PLAIN MANAGEMENT STUDY
HONEY CREEK WATERSHED
VIGO COUNTY, INDIANA
FLOOD PROFILES
HONEY CREEK
PRESENT CONDITION
SHEET 2 OF 5



U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FLOOD PLAIN MANAGEMENT STUDY
HONEY CREEK WATERSHED
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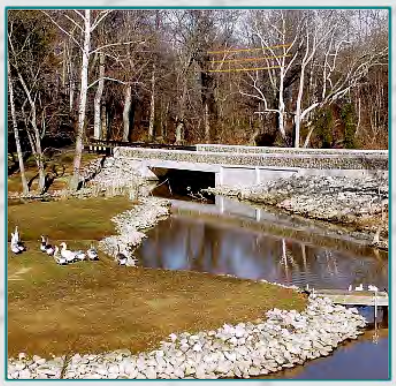
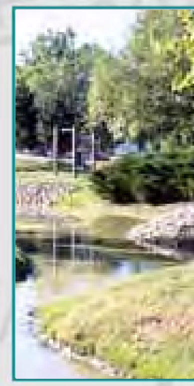
SHEET 3 OF 5





CHRISTOPHER B. BURKE ENGINEERING, LTD. - INDIANA
National City Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
Phone: 317.266.8000
Fax: 317.632.3306
cbbel-in.com

Crown Point Office
One Professional Center, Suite 314
Crown Point, Indiana 46307
Phone: 219.663.3410
Fax: 219.663.3450
nw-in@cbbel-in.com

Fort Wayne Office
130 West Main Street, Suite C
Fort Wayne, Indiana 46802
Phone: 260.422.9395
Fax: 260.422.3159
fortwayne@cbbel-in.com

South Bend Office
340 South Columbia Place, Suite 110
South Bend, Indiana 46601
Phone: 574.282.8001
Fax: 574.282.8003
southbend@cbbel-in.com

Columbus Office
50 Washington Street, Suite 2A
Columbus, Indiana 47201
Phone: 812.376.9252
Fax: 812.376.9260
columbus@cbbel-in.com

Evansville Office
100 NW Second Street Suite 312
Evansville, Indiana 47708
Phone: 812.422.6568
Fax: 812.422.6824
evansville@cbbel-in.com